

Original Article

Population health-based approaches to utilizing digital technology: a strategy for equity

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Abstract Health care disparities and high chronic disease rates burden many communities and disproportionately impact racial/ethnic populations in the United States. These disparities vary geographically, increase health care expenses, and result in shortened lifespans. Digital technologies may be one tool for addressing health disparities and improving population health by increasing individuals' access to health information—especially as most low-income U.S. residents gain access to smartphones. The Aetna Foundation partners with organizations to use digital technologies, including mobile applications, data collection, and related platforms, for learning and sharing. Projects range from the broad—childhood education, lifestyle modification, health IT training, and nutrition education, to the specific—local healthy foods, stroke rehabilitation, and collection of city-level data. We describe our approaches to grantmaking and discuss lessons learned and their implications. When combined with sound policy strategies, emerging, scalable, digital technologies will likely become powerful allies for improving health and reducing health disparities.

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The Reality of Health Disparities

Inequities exist across the health care system in the United States, significantly affecting—and tragically shortening—people's lives while also taking a major toll on the economy. Population-level racial and ethnic disparities in United States health care cost up to \$309 billion annually¹ and persist after controlling for insurance status,



income, age, and disease severity.² These disparities relate predominantly to disease prevalence, use of services, use of evidence-based treatment, and health outcomes.^{2–4}

In just one example of disparities in disease prevalence, rates of diagnosed Type 2 diabetes are 66 per cent higher in non-white Hispanics and 77 per cent higher among blacks compared to white U.S. residents, and adequate glucose control is also less common within these two groups.^{5,6} People diagnosed with diabetes without adequate glucose control incur more medical and pharmacy expenses and are more likely to experience diabetic complications including heart, kidney, nerve, and eye disease.⁷ Chronic diseases besides diabetes also disproportionately affect underserved communities, including cardiovascular disease, stroke, and heart disease.⁸

As we explore the root causes of such disparities, we cannot escape the strong correlation between health and the community in which an individual lives. Looking across our country, place matters, a person's postal ZIP code is a stronger predictor of overall health than many other factors, including race and genetics.⁹ Two cases in point: the life expectancy for a newborn in New Orleans can vary as much as 25 years between neighborhoods that are only a few miles apart¹⁰; in Boston, a census tract in Roxbury has the city's lowest life expectancy¹¹ — 58.9 years — shorter than what is common in many developing countries. Access, whether it be to care, health information, healthy foods, or other health-promoting opportunities, significantly impacts quality of life and is largely determined by the social and infrastructural consequences of where a person lives.

Because disparities vary with geography, it is imperative that efforts to improve health equity engage people where they spend their time — at home, in school, taking part in community or faith-based activities, or simply pursuing their daily routines in the neighborhood. One of the most promising strategies for achieving such holistic engagement takes advantage of a small but potent technology: the smart phone.

Digital Technology — Mobile Personal Engagement

Smartphones are rapidly becoming ubiquitous. In 2015, in the United States, nearly two in three adults (64 per cent) owned a smartphone, up from 58 per cent in 2014 and 35 per cent in 2011.¹² Low-income

people in the United States (income below \$30,000) are not exempt from this trend, with 1 in 2 low-income adults owning a smartphone in 2015, up from 43 per cent in 2013.^{12,13} Importantly, underserved populations are more likely to have smartphones—blacks and Hispanics are 15 per cent more likely to own a smartphone than non-Hispanic whites, and people in cities are more likely to own a smartphone than their suburban or rural counterparts.¹²

Beyond relying on their smartphones to communicate, people are employing them to seek health information—in 2015, nearly two-thirds of smartphone owners (62 per cent) say they have used their phone in the past year to look up information about a health condition.¹² Indeed, in 2012, Fox and Duggan noted that black and Hispanic groups were 35 per cent more likely than non-Hispanic whites to use their phones to look up health information.¹⁴ Health-related community events, such as walks and races, seasonal farmers' markets, and educational events are more easily discovered with mobile devices. Today 56 per cent of smartphone owners use their phone at least occasionally to learn about community events or activities, with 18 per cent doing this frequently.

Diverse applications link people to information that can facilitate healthier behaviors. Many others complement them and can become intimately entwined with daily life. Most people in the United States (60 per cent) keep track of their weight, diet, or exercise.¹⁵ In the U.S., one-third (33 per cent) track health indicators or symptoms such as blood pressure, blood sugar, and sleep patterns.¹⁵ Already, technology can greatly simplify these accounting tasks. And smart technologies are in their infancy—in 2012, a mere 19 per cent of smartphone owners had a health app installed on their phone.¹²

The social dimension of these technologies can also be very powerful. In the clinic, patients can now chronicle their health progress for physicians using precise numbers, rather than anecdotes. Patients can also share progress with friends, family, or even the entire public, creating an avenue for dialog, feedback, and encouragement toward achieving important health goals.

Innovations and miniaturization of technology can only broaden these capabilities. Many smartphones—or even wrist devices—come with sensors to monitor health-related data such as heart rate and steps taken, and whether the person is running, walking, ascending, or descending. Data derived from this real-life activity may provide fresh



opportunities for measuring the effectiveness of a range of programs and initiatives, and ultimately health policy.

These digital innovations offer a range of surprising opportunities. In the living room, video game systems—once merely passive entertainment—are employing fitness software and accessories to motivate intense physical activity, while the bathroom scale has evolved to measure many health metrics beyond weight. In the realm of more serious health conditions, the advent of small, portable heart monitors that record electrocardiograms may help us to improve health outcomes at the community level. Already, some studies are evaluating the use of these devices to screen for atrial fibrillation to prevent stroke¹⁶ and to screen members of the public during visits to their local pharmacy.¹⁷

Philanthropy's Role in Accelerating Technology's Impact

The Aetna Foundation takes a long-term, systematic view of grant-making. It focuses on promoting wellness, health, and access to high-quality health care. We partner with and fund large organizations, helping to advance their pioneering initiatives for improving health among large populations in the U.S. and internationally. At the same time, we provide grants to local U.S. nonprofits, with the specific aim of inspiring healthier lifestyles and creating healthier communities. Underpinning these national and local efforts is our foundation's emphasis on improving health equity, particularly for underserved populations who have limited access to education, resources, and medical care.

To ensure that we are leveraging our funding dollars for maximum effect, we evaluate all prospective grantees' projects by applying strong evidence-based criteria. These criteria include sustainability, scalability to national or international levels, potential for positive societal impact, leveraging of available evidence such as population health data or health care data, and digital health technologies built on a strong foundation of behavioral research or other applicable theories.

When we analyze a grant application through the lens of potential societal impact, we ask our partners to explain how their work will effect change and for whom. As part of this process, we ask them to

define specific goals, strategies and tools, and methods to measure progress. When we review through the lens of scalability, we want to know whether a grantee's program, if successful, can be replicated elsewhere. Our goal is to effect broad-based change and to drive results that are exponentially more significant and far-reaching.

Advancing Diverse Technology Initiatives

Last year we launched our “Healthier World Innovation Challenge,” an initiative designed to foster digital health innovations that measurably improve chronic health outcomes in underserved communities. The Challenge is part of our larger, three-year digital health commitment to help address public health concerns. As we continue to receive both qualitative and quantitative results from our many partners and initiatives, we have some promising indications that emerging technology is engaging underserved populations in the context of their daily lives, where behavioral change is possible.

Our “digital” funding initiatives complement a range of existing philanthropic activities we have pursued with multiple partners at the national and local levels in recent years. Our goal with all of these partners is to harness digital approaches—from mobile applications, to data-driven insights, to new platforms for learning and sharing—to see if, and to what degree, they can impact the health disparities challenge. The following are highlights of several of these recent partnerships:

1. Using technology to shape healthy habits before adulthood: Landon Pediatric Foundation

Young adults have much to learn about diet, nutrition, and exercise and may benefit from accessing quality health education curricula outside of school, through PCs or mobile devices. California-based Landon Pediatric Foundation has been exploring a classroom-focused approach since 2011, when it successfully piloted its “My Healthy World” program in low-income community schools in Arizona, California, and Maryland. The program's K-12 digital health curriculum combines the fun of online capabilities to broadcast a classroom-like health education experience that encompasses diet and nutrition, fitness, and disease prevention and management. With Aetna Foundation support, they



expanded the program to additional school districts and are evaluating and refining it, so it can be positioned for a future national rollout.

Results so far: In a four-city, multi-region implementation, two groups of children were evaluated—the first at the 3rd and 4th grade levels, the second at the 5th and 6th grade levels. A statistically significant increase in knowledge occurred in both student groups, and there were promising indications of improvements in attitudes and behaviors related to health. Specifically, following the *Eat Healthy* program component, both student groups reported that they better understood how to make healthier food choices, and that they had increased consumption of fruits and vegetables. The 3rd and 4th graders did not significantly change certain other behaviors, such as considering health and/or calories when choosing foods, reading nutrition labels, or encouraging friends and family to eat healthy foods. The 5th and 6th graders improved these behaviors by only a small degree. Following *Live Healthy* lessons, both student groups reported that they better understood how physical health and exercise affects them, and that they had increased their levels of physical activity. In addition, the 5th and 6th graders reported lower levels of daily “screen time.”

2. Easing everyday rehabilitation for stroke survivors: Towson University

For survivors of strokes, rehabilitation exercises are critical for recovery, yet many find it hard to adhere to these repetitive regimens. Video game systems show promise for boosting engagement, but seniors, common victims of stroke, are not always comfortable using these systems. Seniors do, however, tend to be familiar with mobile phones. What has been missing is an application that might act as a stroke rehabilitation tool. With our help, Towson University Foundation is striving to fill this gap with its mobile app for stroke survivors. The app’s games are actually exercises for flexibility, coordination, and strengthening. Doctors can customize therapy by selecting exercises and changing settings. Exercise data are logged and sent to caregivers who monitor the patient’s progress. Overall, the app’s data and communication features aim to improve care coordination and inform decisions by linking stroke survivors, therapists, physicians, and caregivers. We are awaiting tabulation of the metrics for this innovative program, which will allow us to evaluate its impact.

3. Mentoring mobile health innovators

As mobile health (mHealth) approaches reveal new possibilities for effecting better health outcomes, we are helping to cultivate the next generation of innovators who will shape this future. In 2014, for example, the Aetna Foundation co-hosted an mHealth Training Institute in Washington, D.C. with our partners, the Healthcare Information and Management Systems Society (HIMSS), and the National Institutes of Health. The Training Institute focused on mobile technologies as a gateway to reducing health disparities and brought together leaders in mobile technology, behavioral sciences, and clinical research to lead this cross-training event. We provided scholarships for early-stage investigators with an interest in mHealth to attend the Training Institute and have since formed an informal relationship with these scholars to continue the dialog about mHealth's potential for addressing health disparities.

4. Sharing web-based resources for healthy eating: Leah's Pantry

Processed foods are less nutritious than fresh fruits, vegetables, and whole grains, but they tend to be less expensive, making them a fallback choice for families of limited means and those living in food deserts. This is one reason why several California counties report obesity rates that are 50 per cent higher among users of the state's Supplemental Nutrition Assistance Program (CalFresh). For nearly a decade, Leah's Pantry has battled this trend by conducting cooking and nutrition workshops; they also launched EatFresh, a web-based resource that aims to reduce chronic disease among the 5.3 million CalFresh-eligible Californians by encouraging healthy diets and lifestyles. The website offers recipes and nutrition information in multiple languages, teaches basic cooking skills, and encourages home cooking with fresh fruits and vegetables. Drawing on our support, Leah's Pantry used surveys, focus groups, and data analysis to gauge the effectiveness of EatFresh and its potential as a national model. The organization is learning how EatFresh changes knowledge, attitudes, and behaviors with respect to buying, preparing, and eating fresh foods.

Results so far are promising. A preliminary evaluation of EatFresh found that users were significantly more likely to

- Know how to read a nutrition label (95 per cent vs. 76 per cent);
- Know how to use a grocery list when they shop (92 per cent vs. 79 per cent);



- Know how to avoid foods with added fats, salt, and sugar (84 per cent vs. 77 per cent); and
- Believe that what you eat can make a difference in your chances of getting heart disease or cancer (96 per cent vs. 88 per cent)

Users were also more likely to: believe that they will have more energy if they eat fruits and vegetables; plan meals before shopping; and cook dinner at home. Additionally, 71 per cent of users have made at least one recipe from EatFresh.org. (31 per cent have made one recipe, 20 per cent have made two recipes, and 20 per cent have made three or more recipes).

5. Bringing fresh, local food to table: Fair Food Network

Those who live in the poorest neighborhoods often have the least access to outlets with affordable healthy food. To respond to this issue, the Fair Food Network in Michigan is drawing on our funding support to test a smartphone app that will increase healthy food access for underserved communities while also creating new markets for urban farmers. The app advances mobile payment technology by processing food assistance benefits more simply and affordably at farmers' markets. This not only allows for widespread adoption of Supplemental Nutrition Assistance Program (SNAP) benefits and incentive programs by farmers who grow nutritious foods, thereby helping to ensure that these foods are served at dinner tables across the community, but also has the potential to impact local economic growth through vendor profitability.

Results so far: Vendor (farmer) enthusiasm for this electronic payment system has been high, albeit with some signs of declining support. In 2014, 96 per cent of vendors said they would participate in the program again, with only 87 per cent saying this in 2015. This year-over-year decline is likely due to initial technical difficulties that has led to vendor's preferring the fallback, a token-based payment system. Despite the need to improve the system for vendors, customer support remains high—in 2015, 97 per cent of customers said that they intended to return to their farmers' market of choice. Customers also favor the electronic payment system over the token system (by +8 per cent). Importantly, 89 per cent of customers say they are purchasing

(and their families eating) more fruits and vegetables. During the years that this program was in effect, vendor support and use of this electronic payment system have taught and allowed individuals and families to obtain fresh fruits and vegetables in new places that previously had no support for payment using SNAP.

6. Building personalized experiences to affect behavior: Washington University

An important first step in adopting healthy behaviors is to have clarity about one's current health status and disease risks. To this end, the Washington University School of Medicine in St. Louis published an evidence-based iPad app, Zuum. The app asks a user to complete a brief survey and then lists the user's healthy habits alongside lifestyle modifications that could further reduce disease risks. Users can send these results to doctors, family members, or friends, thereby enabling positive reinforcement. With Aetna Foundation support, Washington University is assessing the feasibility of integrating Zuum into various clinical care settings in urban St. Louis, Missouri, and rural Illinois, where the population is largely low-income, underserved, and underinsured.

Results so far: During feasibility studies, 70 per cent of eligible patients at Federally Qualified Health Centers (FQHCs) participated in a Zuum intervention. Of patients who used the app ($n = 62$), 95 per cent reported in follow-up surveys that it was easy to answer Zuum questions. Only 6 per cent of eligible patients were unable to complete the Zuum intervention components prior to a physician appointment. This suggests that Zuum could realistically be administered to all patients prior to seeing their physician, as it takes an average of 5 min to complete and only 1 in 4 participants needed assistance operating the app. These results lend credence to the idea that digital interventions can be used to educate patients on disease risk factors that they have the power to modify, in settings where time and resources are limited.

7. Improving city health through data-driven insights: Camden Coalition of Healthcare Providers

The Aetna Foundation and its grantees recognize the value of data collection for zeroing in on root causes of health disparities. In one example, the Camden Coalition of Healthcare Providers, in Camden, New Jersey, is collecting and integrating social data with health data.



Camden is among the nation's poorest cities. An estimated 30 per cent of health care spending is devoted to 1 per cent of the city's population. Many people seek costly and inefficient emergency department care for problems that preventive care might have helped to avoid. With our Foundation's support, a Social Determinants of Health Database (SDD) is being created, aggregating social data from agencies serving the Camden community. The SDD centralizes information such as employment status, educational attainment, homelessness, and law enforcement records. We hope that analyses using the SDD will reveal social issues that affect care and help illuminate particularly vulnerable groups. The SDD may also generate cost savings by clarifying how health services are used across Camden—essential knowledge for the city to efficiently distribute its limited resources.

Results so far: Data sharing agreements have been established with non-healthcare partners, leading to reports that have revealed correlations between health data and social data. Hospital over-utilization, for example, has been linked to housing instability, substance abuse, mental health status, and involvement in the criminal justice system. External researchers have partnered with the Camden Coalition to begin publishing these and other findings in peer-reviewed journals. (ref) As work continues, Camden healthcare providers better understand their patients' lives. As the difficult work of analyzing and disseminating their findings continues, the actionable data they unearth may affect other communities.

Discussion

Our grantmaking in the digital health space has resulted in exciting work with strong partners who are dedicated to investigating whether technology can be used to advance health equity and improve population health outcomes. That said, funding innovations requires a strategic approach that acknowledges the opportunities and risks involved in investing grant dollars in the digital health arena. Although the potential for return on investments is significant, funding innovations involves becoming more comfortable with a higher level of risk. Perhaps the philanthropic sector may be able to embrace this challenge. Funders are constantly seeking out the true “game changers,” but it is important to acknowledge that these do not necessarily emerge from a

standard RFP (request for proposals) process, and it may take new methods to draw innovations from the field; flexibility in how work is solicited and developed. Convening multidisciplinary stakeholders to identify opportunities for innovation in vulnerable communities can initiate important conversations and partnerships that could be key in moving the field forward. In the age of “the next big thing,” it is tempting to get swept up in the hype of the technology; however, it is critical to ensure that the innovations are truly centered on the community’s need. Using digital health technology as a strategy for equity should include community-centered design and implementation strategies as well as a cross-sectoral approach that takes into account social determinants of health.

Overall, our initiatives range from early ventures where there are few quantitative data yet available for evaluating program impact, to completed trials that show statistically significant improvements in healthy behaviors and knowledge (but sometimes show limited effects), and to effective apps that must overcome challenging technical implementations to continue having a positive impact. We hope that the encouraging data and anecdotes that we describe herein will help other grant makers in their efforts to harness digital technologies for health.

Conclusion

Digital technology is providing us with a powerful new set of tools that a few of our initiatives have used to address health disparities at the population level. Mobile technology’s potential benefits are particularly compelling because of the ubiquity of smartphones in low-income, underserved communities, and because mobile technologies can be customized to target specific health risks and conditions. They can also be personalized to motivate positive individual behavior change through information, activities, and dynamic reinforcement.

These emerging technologies, when accompanied by sound policy and coordinated community action, may reduce health disparities both in specific cities or regions. The magnitude of positive impact will depend on improved designs and unrelenting optimization. The Aetna Foundation is proud to partner with organizations that are building the technology-driven innovations that are starting to improve health for people no matter where they live.



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